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CONTENTS



## RADIO SOUNDINGS AND WEATHER PREDICTION

The past year has seen the transformation of the radio sonde (variously referred to as radio meteorograph or radio telemeter) from an experimental apparatus, requiring individual handling, into a commercial product, reasonably priced because of the application of mass production methods, and capable of meeting rigorous performance specifications under field operating conditions. Beginning June 1, 1938, the Navy Department inaugurated routine use of the radio sonde at the Naval Air Station, Washington, D. C., and during July 1938 the Weather Bureau began routine operation at Nashville, Tenn., Oklahoma City, Okla., Omaha, Nebr., Oakland, Calif., Fargo, N. Dak., and Sault Ste. Marie, Mich.

Radio-sonde service at two other Navy Department stations and at two Army stations was started in December 1938. In all, during 1938, some 1,500 radio soundings were made in the regular course of collecting upper-air weather data.

The instrument used at the Weather Bureau and Navy Department stations is of the type developed at the National Bureau of Standards with funds provided by the Navy Department. The details of design and of the experimental performance of this device were published in several papers during 1937 and 1938. A paper by Harry Diamond, W. S. Hinman, Jr., A. H. Mears, and C. Harmantas, which will be published in the Journal of Aeronautical Sciences, outlines the improvements incorporated in this radio sonde to facilitate mass production while retaining its accuracy of performance and simplicity of use. The engineering staff of Julien P. Friez & Sons Co. contributed materially to these improvements.

The paper also presents an analysis of the performance of the radio sonde in 6 months of routine use at seven aerological stations. A quantitative evaluation of the accuracy of the radio-sonde observations under field operating conditions is included, and it is shown to be well within the specifications formulated by the Weather Bureau for this service. Upper-air obser-

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vations of pressure, temperature, and humidity are obtained to an accuracy compatible with the requirements of the analytical methods employed in weather forecasting.

Based on Weather Bureau data, it is shown that the inauguration of radiosonde operation (in place of the airplane method of upper-air soundings hitherto employed) has resulted in a marked improvement in the regularity of the daily schedule of observations and in the altitude to which observations are made. To obtain full value from the upper-air observations, it is essential for the forecasting division to have complete and accurate information from all stations in its hands by 7:30 a. m. EST, which is the time of the ground observations from which the morning daily maps are constructed. This requires that the actual upper-air soundings be started considerably earlier to allow the balloon to reach its top height (20 kilometers), or the airplane to reach its ceiling height (6 kilometers) and to bring back its record. In the event that the start of a sounding is delayed for any reason, such as unfavorable flying conditions in the case of the airplane soundings, the data are not available in time for use in forecasting. Such loss of data is particularly serious in the case of outpost stations, such as Sault Ste. Marie, Mich. These are key stations in the Weather Bureau network.

The Sault Ste. Marie station stands as an outpost sentinel to give information concerning the development of cold waves which affect the thickly settled and highly industrialized eastern part of the United States. Regularity of data from Sault Ste. Marie is of particular importance because cold waves are usually associated with fast action in the atmospheric flow and can occur with great and sometimes unexpected suddenness. It is precisely at such a station that adverse flying weather occurs with considerable frequency and serves to postpone or cancel airplane soundings. The use of radio sondes at this station has practically eliminated interruptions in the regularity of observations. Even at a station such as Oakland, where weather conditions are usually favorable to flying, the regularity of observations with the radio sonde surpasses that for airplane soundings for corresponding seasonal periods.

The increased range of observations possible with the radio sonde is apparent from the ceiling height of the balloon, 20 kilometers, as compared with the ceiling height of the airplane, 6 kilometers. There is some loss (in the radio-sonde method) of observations such as may be made by the pilot in an airplane sounding; for example, the heights of cloud bases and tops, haze layers, and levels where ice formation takes place; however, such information may be derived indirectly from the radio-sonde data. The greater height attained and the increased regularity of observation far outweigh this disadvantage.

An added advantage for the radiosonde method is pointed out on the basis of the reduction in total time required for a sounding. At the present time, a balloon rate of ascent of 200 meters per minute is employed, so that 100 minutes is required to obtain information to 20 kilometers. A new humidity device with a faster response is now under development at the Bureau, and when it is adopted the rate of balloon ascent may be doubled, reducing the time for a complete sounding to 50 minutes. The average airplane sounding to a height of only 6 kilometers requires about 90 minutes.

## STRATOSPHERE ULTRAVIOLET METER

A new radio stratosphere ultraviolet meter which operates with a precision comparable with that of laboratory instruments is described in RP1181 by R. Stair, in the March Journal of Research. The improved instrument consists of a photoelectric cell, a balanced amplifier, a relaxation oscillator, and a transmitter. The calibration of the instrument is automatically determined and broadcast to the receiving station each time an altitude signal is given. The instrument, with accessories, including sufficient batteries to operate for about four hours, weighs about five pounds. It operates on a frequency of approximately 50 megacycles and has sufficient power to insure good reception for distances from the receiving station up to 100 miles.

## SPECTROCHEMICAL ANALYSIS

For about a quarter of a century the spectroscopy section at the Bureau has maintained for information purposes a card catalog of current publications on atomic spectra, one section of which is devoted to practical applications to chemical identification and quantitative analysis. This valuable collection containing more than 900 items was brought to the attention of the American Society for Testing Materials, and at the suggestion of that society, Wil-

liam F. Meggers and Bourdon F. Scribner of the Bureau prepared a single list of titles of the numerous and widely scattered publications on spectrochemical analysis. This list has recently been published and is available by purchase from the American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa., for $1.00 each, with a reduction of 25 percent to members of the society.

While a number of reviews containing numerous references to particular applications have been published to date, Megger's and Scribner's list is the only general comprehensive index to spectrochemical literature which has appeared. Since workers in this field are now able to locate the voluminous and far-flung literature on the subject, they should be able to orient themselves and to profit by the experience of others.

The authors point out that spectrum analysis, notwithstanding certain limitations, has aided and extended gravimetric and colorimetric chemical methods, has already displaced gravimetric analysis in many instances of routine or control work, has opened new fields in science and industry, and bids fair to go still further.

## PREPARATION OF OXYGEN OF HIGH PURITY

The Bureau cooperates with other national physical laboratories in establishing the International Temperature Scale. This scale is the reference standard against which all measurements of temperature are ultimately compared. One of the defined points of this scale is the normal boiling point of pure oxygen, —182.97° C. RP1182, by Martin Shepherd, E. R. Weaver, and S. F. Pickering, which will be published in the Journal of Research for March, describes the preparation of oxygen of high purity which was used as one of the reference samples in the determination of the oxygen point of this temperature scale.

## ESTABLISHMENT OF A LOW-TEMPERATURE SCALE FOR CALIBRATING THERMOMETERS

Above —190° C, thermometers are calibrated at the Bureau on the basis of the International Temperature Scale—the scale used by most of the standardizing laboratories of the world. This scale does not extend below —190° C and heretofore the Bureau has not calibrated thermometers for the public below this temperature. It has been necessary for laboratories desiring to make precise temperature measurements between —252° and —190° C to calibrate their thermometers by comparison with a gas thermometer. Not only is this time consuming, but it is not satisfactory, because the precision of gas thermometry is not high, and different laboratories have established different secondary scales of temperature based upon their calibrations of their resistance thermometers or thermocouples.

The use that is being made of temperatures below —190° C, for both scientific and industrial purposes is steadily increasing, and, as a consequence, the need for the calibration of thermometers for this low range is growing. In order to promote scientific research and the industrial application of temperatures below —190° C, a temperature scale extending from —260° to —190° C has recently been established at the Bureau for the calibration of thermometers.

In setting up this scale, which is described in the March Journal of Research (RP1188), Harold J. Hoge and F. G. Brickwedde compared seven carefully annealed resistance thermometers (six platinum and one platinum–10-percent rhodium) with a gas thermometer. In the future, thermometers submitted for calibration will be compared with these calibrated resistance thermometers. At present the newly established scale is maintained by the seven resistance thermometers. However, it is intended that the scale shall be based upon fixed points, that is, boiling, triple, and transition points of pure substances, and determinations are now being made of the temperatures of fixed points on the newly established scale. The temperatures found for the boiling and triple points of normal hydrogen on this scale are —259.20° and —252.77° C (13.96° and 20.39° K), respectively.

## EFFECT OF THE SOLUBILITY OF GLASS ON THE BEHAVIOR OF THE GLASS ELECTRODE

The reported voltage departures of the glass electrode in (1) the majority of alkaline solutions above pH 8.5, (2) high concentrations of acid solutions, (3) concentrated salt solutions, (4) ethanol solutions and (5) for elevated temperatures have been studied by Donald Hubbard, Edgar H. Hamilton, and Alfred N. Finn in connection with the solubility of the glass customarily

used for making glass electrodes. As reported in RP1187 (Journal of Research for March), for every case investigated, voltage departures of the glass electrode have been found to be accompanied by changes in the solubility of the glass.

## REPRODUCIBILITY OF SILVER-SILVER HALIDE ELECTRODES

Previous work has shown that in neutral solutions the electrolytic, thermal-electrolytic, and thermal types of silver-silver chloride electrodes come finally to agreement in potential within about 0.02 mv, and that this potential is unaffected by the presence of oxygen and by exposure to light. The time required to attain this equilibrium potential depends on factors which include the porosity of the electrodes and the nature, concentration, and stirring of the solution. In an investigation reported in RP1183, by John K. Taylor and Edgar R. Smith, which will be published in the March Journal of Research, the work was extended with the following results:

The potential of the silver-silver chloride electrode in acid solution is affected by the presence of oxygen. Electrodes in contact with oxygen become cathodic with respect to those protected from oxygen. The aging effect is exhibited in acid as well as in neutral solutions.

Silver-silver bromide electrodes are subject to the aging effect, and in neutral solutions are not affected by the presence of light or oxygen. In acid solutions, however, they are affected in potential by the presence of oxygen. The electrolytic, thermal-electrolytic, and thermal types attain the same final potential to within about 0.02 mv.

Silver-silver iodide electrodes show an aging effect, and are not affected in potential by light. The presence of oxygen disturbs their potential to a greater degree than that on the silver-silver chloride and silver-silver bromide electrodes, the disturbance occurring even in neutral solutions. The thermal-electrolytic type of the silver-silver iodide electrode appears to be more reproducible than either the electrolytic or the thermal type.

## COMPARISON OF 2,6-DIMETHYLHEPTANE WITH ISONONANE

In the separation of the constituents of petroleum which is being carried on at the Bureau by the American Petroleum Institute Research Project 6, there was isolated several years ago, from a midcontinent petroleum, an isononane normally boiling at 135.2° C. On the basis of the meager data then available, the isononane was tentatively identified as 2,6-dimethylheptane. Now, Joseph D. White, F. W. Rose, Jr., and G. Calingaert have synthesized 2,6-dimethylheptane by means of the Grignard reaction, and have compared the properties of a purified fraction with those of the isononane from petroleum. The properties of the isononane are in good accord with those of 2,6-dimethylheptane. The properties of the latter (extrapolated to a purity of 100.0 percent from measurements actually made on material of purity 99.6 mole percent) are as follows: Boiling point at 760 mm Hg, 135.21±0.02° C; freezing point in air, —102.95±0.10° C; density at 20° C, 0.70891±0.00003 g/ml; refractive index, $n_D^{20}$ 1.40073±0.00005; critical solution temperature in aniline, 80.0±0.3° C.

RP1184 in the March Journal of Research should be consulted for a complete account of this work.

## ADSORPTION OF HYDROCARBONS ON SILICA GEL

Silica gel has been used for a number of years for the complete removal of small quantities of aromatic hydrocarbons from naphthene and paraffin mixtures occurring in the gasoline fraction of petroleum ($C_8$—$C_{10}$), but no information has heretofore been available concerning its effectiveness for the separation of the hydrocarbons of higher molecular weight ($C_{28}$—$C_{33}$).

In recent experiments which Charles B. Willingham has performed on known mixtures of pure hydrocarbons, a sharp separation of 5-(7-tetrahydronaphthyl)-docosane from 5-(2-decahydronaphthyl)-docosane, and *n*-dotriacontane from 1-(*p*-diphenyl)-octadecane was obtained. Some separation of 1-(*p*-diphenyl)-octadecane from 5-(7-tetrahydronaphthyl)-docosane was found, but the separation was not as sharp as with the two preceding mixtures. No separation of a mixture of *n*-dotriacontane and 5-(2-decahydronaphthyl) - docosane was found.

The capacity of 20 g of silica gel to adsorb preferentially the more aromatic component of these mixtures was found to be 1.8, 3.3, and 0.8 g, respectively, for the first three mixtures listed above.

The complete account of this work will be published in the March Journal of Research as RP1185.

## FLUIDITY TEST FOR QUALITY OF CELLULOSE FIBERS

One of the most sensitive indications of the quality of cotton, rayon, and other cellulose fibers is the apparent fluidity of a cuprammonium solution in which a definite amount of the fiber in question is dispersed. The fluidity test has been studied recently in the Bureau's textile section by R. T. Mease, who gives detailed directions for making it in the Journal of Research for March (RP1179).

The test is particularly applicable for the measurement of small changes in cellulose resulting from the action of light, laundering, mildew, bacteria, acids, bleaching agents, and the like. It should, therefore, be of general interest.

In making the test, the weighed sample of cellulose is dissolved in a cuprammonium solution carefully standardized to contain 240 ±5 g of ammonia per liter, 15 ±0.1 g of copper, and less than 0.5 g of nitrites and nitrates calculated as nitrous acid. Dispersion of the cellulose is effected in a closed tube to prevent loss of ammonia. The rate at which the solution flows from the orifice of the tube is observed. The apparent fluidity of the liquid is calculated from the calibration of the tube.

The paper describes the equipment that is used at the Bureau in making the test. Although it has been specially designed for the purpose, it can be readily constructed in most laboratories. The precautions to be taken in the preparation and storage of the cuprammonium solution are discussed. The construction and calibration of suitable viscometers are described, and data are given showing the duplicability of results with different viscometers and with the same viscometer.

## DOPED FABRICS FOR AIRCRAFT

Despite the extensive use of metal construction in the fabrication of modern commercial and military aircraft, doped fabric continues to meet a need for a light and relatively inexpensive covering for low-stressed members and for the wings and fuselages of small airplanes. The "dope," which is applied to the fabric to make it impermeable to air and to weatherproof it, consists of a film-forming material dissolved in organic solvents. Cellulose nitrate is at present commonly used as the film-forming base, but it is easily ignited and the rate of burning is very rapid. The Bureau of Aeronautics of the Navy Department, therefore, requested the Bureau to develop a nonflammable dope which would compare favorably with, or surpass, cellulose nitrate dope with respect to the effects of normal aging and high relative humidity on the tautness of the doped fabric.

In a previous report (J. Research NBS 20, 651 (May 1938) RP1098), it was shown that the solvents and diluents in a dope govern to a large extent its tautening properties and the durability of the film deposited on the fabric. The four variables involved in the formulation of airplane dopes are the type of plastic, plasticizer, solvent, and diluent. A second report by F. W. Reinhart and G. M. Kline of the organic plastics section, which will be published in Industrial and Engineering Chemistry, presents the results of an investigation of the effect of these variables upon the properties of films formed from various plastics. The plastics examined were cellulose acetate, cellulose triacetate, hydroxypropylcellulose triacetate, cellulose acetopropionate, cellulose acetobutyrate, cellulose nitrate, ethylcellulose, benzylcellulose, chlorinated rubber, methyl methacrylate resin, and isobutyl methacrylate resin. Data are included on the solubility of these plastics in common organic solvents and mixtures of solvents and diluents, their compatibility with various plasticizers, and the degree of flexibility, clarity, and shrinkage of the films prepared from the plasticized and nonplasticized compositions.

On the basis of the information obtained with the single solvents and solvent-diluent combinations, various mixtures were formulated in an endeavor to obtain flexible, clear films characterized by marked shrinkage, qualities which are of prime importance in a good airplane dope. This process of selective formulation and testing was continued for each material until no further improvement in the desired film properties was noted. The solutions chosen in this manner, with the addition of selected plasticizers, have been applied to fabric-covered test panels to determine their tautening properties and the weathering characteristics of the deposited film. Exposure and flammability tests on these experimental panels are now under way.

## PRINTING TESTS OF EXPERIMENTAL BOOK PAPERS

During the past 4 years the extent to which composition and manufacturing

processes affect the stability of paper has been investigated at the Bureau. The influence of filling and sizing materials on book paper was recently reported. Tests to evaluate the printing quality of the experimental papers manufactured in that investigation have since been made. The additional data reported by Merle B. Shaw and Robert H. Simmons in the Journal of Research for March (RP1180), consist in laboratory measurements of comparative smoothness, oil penetrability, and air permeability at the Bureau, and of actual printing trials at the Government Printing Office.

As a group, the precipitated calcium carbonate-filled papers had the best printing quality. Little difference attributable to fiber was shown in the printing quality of the papers made from old rags, sulfite-soda, or purified-wood book pulps, all being satisfactory. The test results apply only to the materials used, which were representative at the time the work was done. The relationship may be changed with further improvement in quality of the materials as a result of advances in manufacturing technic.

Opacity and smoothness are known to be related to printing quality. Less is known of the relation of oil penetration and air permeability, but it is believed that they also are indicative of the behavior of paper in actual printing. As data on the tests are accumulated and correlated with quality of printing, the tests should be of value in paper specifications.

## COMMERCIAL STANDARD FOR DOMESTIC GRADES OF DOUGLAS FIR PLYWOOD

Printed copies of Douglas Fir Plywood (Domestic Grades) (Third Edition), Commercial Standard CS45-38, are now on sale at the Government Printing Office at 10 cents a copy. The standard became effective on November 10, 1938. This revision marks a definite step forward in the Douglas fir plywood industry through the establishment of a voluntary standard as a guide for the production, distribution, and sale of the product, including changes based upon experience in the operation of the standard since 1933, when the first edition became effective.

The current revision includes two major departures which have been awaited by distributors and ultimate users of this versatile product. The first departure is the establishment of moisture-resistant requirements which were desired as a basis for identification of this material in house construction covered by Federal Housing Administration mortgage loans.

Plywood manufactured for outdoor application, where it is fully exposed to the weather, is characterized as "Exterior Plywood" (EXT.) and is required to meet specific requirements of alternate wetting and drying for three cycles, including a total of 88 hours of complete submersion. The drying period is conducted at a temperature of approximately 145° F. to simulate outside temperatures sometimes encountered. As an alternate to the above test, the samples may be boiled for two periods of 4 hours each, with an intermediate drying period of 20 hours. Following the alternate wetting and drying, the samples are subjected to a longitudinal shear test to determine the relative residual strength of the bond.

The second departure is the designation of a certain class of plywood as "Moisture-Resistant" (M. Res.). This class covers the material which is generally used for subflooring, sheathing, and general structural purposes. The Commercial Standard requires that this class must be capable of being completely submerged in water for two periods of 4 hours each and dried for two periods of 20 hours each, with a specified minimum of delamination along the edge.

These tests were devised to insure a board which would be capable of meeting the hazards of moisture which are presented in the usual construction practices. In order to aid in the identification and selection of the proper kind of board for each specific use, the Douglas Fir Plywood Association has adopted plans for the grade and trade marking of each of its products.

Grade specifications are given in detail as to the requirements for the several kinds of plywood panels, industrial stock, and concrete form material, while the standard sizes and size tolerances are also indicated. For those unfamiliar with the product there is included a glossary of terms, a table of suggested applications for the several grades, and suggestions for ordering plywood to prevent misunderstandings and delays that usually follow.

According to officers of the association, a competent inspection force will be employed to police the grademarks and trade-marks, the truthfulness of which will be jealously guarded.

These grade-marks, trade-marks, and labels will provide a ready guide to the contractor, the ultimate consumer, and particularly to the F. H. A. or other governmental inspectors for the identification of each grade or class.

Requests for printed copies of the Commercial Standard should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C.

## COMMERCIAL STANDARD FOR DOUGLAS FIR STOCK DOORS

The Bureau has just released Commercial Standard CS73–38, Old Growth Douglas Fir Standard Stock Doors, which sets forth definite quality requirements and size standards of stock house, garage, and cupboard doors, and sidelights made of old growth Douglas fir.

This standard which became effective June 30, 1938, was voluntarily developed by the fir door manufacturers to establish definite classifications of quality for the guidance of the architect, builder, and home owner, and to fix the dimensions of the various type doors to facilitate their ready procurement from local dealers or jobbers.

In the absence of nationally recognized standards, architects have frequently specified doors for a home or building of a grade, type, or dimension not available from distributors' stocks. This necessarily meant that the door had to be custom made, which required as many machine set-ups as there are parts to the door. All of the initial cost of laying out the job and of setting up the machines went into the charge for such special doors. In the mass production of doors of standard stock design, this same cost is divided among the hundreds or thousands of doors the detail features of which are standardized, thus considerably reducing the unit cost.

The specification provides for doors of four different thicknesses, and certain general requirements apply to the material to be employed, workmanship, construction, sticking, inspection, and dimensional tolerances.

Under the detailed requirements there are 73 separate layouts with the necessary dimensions of stiles, rails, panels, etc. Most of these are classified into one or more grades, according to the natural or manufacturing defects which are present.

By referring to the standard and specifying the design number of the door desired, an architect may secure doors to meet his needs with ample competition, prompt deliveries and at a considerable saving in cost.

The personnel of a standing committee for revising the standard to keep it abreast of latest requirements is given, as well as the individuals and organizations that have indicated their acceptance of it.

Copies of CS73–38 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

## PROPERTIES OF "KEYSTONE BEAM STEEL FLOOR"

As part of the program on structural materials for low-cost housing, tests were recently completed at the Bureau on six specimens representing one of the cellular sheet-steel floor constructions of the H. H. Robertson Co. The specimens were fabricated with "FKX 18–18" panels covered by a concrete fill and a "Hubbellite" composition finish floor.

The specimens were subjected to transverse, impact, and concentrated loads. For each of these loads three like specimens were tested, the concentrated load tests being made on undamaged portions of the specimens used for the impact tests. The deformation under load and the set after the load was removed were measured for uniform increments of load, except for concentrated loads, for which the set only was determined. The strength under transverse load was also determined. The results are presented graphically and in a table in Report BMS10 of the series on Building Materials and Structures, copies of which are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

## RELATION BETWEEN MOISTURE CONTENT AND FLOW-POINT PRESSURE OF PLASTIC CLAY

Clay when prepared for molding into desirable forms must contain the proper amount of moisture to conform to the method of molding. For the dry-press process very little moisture is necessary, whereas the moisture content for the soft-mud process is comparatively high. For the stiff-mud process, a value approximately half way between that required for the dry-press and the soft-mud molding consistencies is necessary.

In the molding process the manufacturer is, therefore, dealing with a mixture of two materials, clay and water,

in which the physical properties vary from those of a solid at one extreme to those of a liquid at the other. Information concerning the relation between moisture content and flow-point pressure of clay is meager and lacking in essential details. Ray T. Stull, chief of the Bureau's heavy clay products section, and Paul V. Johnson, therefore, undertook an investigation to obtain more complete data and to determine the mathematical relation between moisture content and the flow-point pressure.

Three clays of different degrees of plasticity were included in the investigation. These were a Maryland clay, a Georgia kaolin, and a Kentucky ball clay. The moisture contents ranged from 17 to 34 percent, for the Maryland clay, 24 to 40 for the kaolin, and 26 to 52 for the ball clay. The flow-point pressures ranged from about 8 to 400 lb/in$^2$.

The data, which will be reported in full in the March Journal of Research (RP1186), indicate that the relation between moisture content and flow-point pressure of the clays is hyperbolic in character and of the form

$$(p+b)(w-a)^m=K,$$

where

$p$=flow-point pressure, in lb/in$^2$.
$w$=moisture content in percent by weight, of the dry clay.

With the equipment used, $a$, $m$, and $K$ are constants for a definite clay but different for different clays, and $b$ is constant for all of the clays.

The value of $a$ represents the percent of moisture with which the hard, dry clay must be imbued before it becomes amenable to flow at, theoretically, infinite pressure.

When $p=0$,

$$w=\left(\frac{K}{b}\right)^{\frac{1}{m}}+a,$$

in which $w$ is the moisture content at the breaking point where the clay would flow, theoretically, under the slightest pressure.

## NEW AND REVISED PUBLICATIONS ISSUED DURING FEBRUARY 1939

### Journal of Research[2]

Journal of Research of the National Bureau of Standards, volume 22, number 2, February 1939 (RP1172 to RP1178, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

### Research Papers[2]

[Reprints from the September, October, and November 1938 Journal of Research]

RP1129. Optical and dimensional changes which accompany the freezing and melting of Hevea rubber. W. Harold Smith and Charles Proffer Saylor. Price 10 cents.

RP1138. Measurement of relative and true power factors of air capacitors. Allen V. Astin. Price 10 cents.

RP1139. Heats of combustion of anthracite cokes and of artificial and natural graphites. Phillip H. Dewey and D. Roberts Harper 3d. Price 5 cents.

RP1140. Heats of combustion of diamond and of graphite. Ralph S. Jessup. Price 5 cents.

RP1141. Heat and free energy of formation of carbon dioxide, and of the transition between graphite and diamond. Frederick D. Rossini and Ralph S. Jessup. Price 5 cents.

RP1142. A continuous high-vacuum still and boiling-point apparatus, and the systematic distillation of a dewaxed lubricant fraction of petroleum. Robert T. Leslie and Wilson W. Heuer. Price 10 cents.

RP1144. Hydrogenation of the "extract" portion of the lubricant fraction from a midcontinent petroleum. Beveridge J. Mair, Charles B. Willingham, and Anton J. Streiff. Price 5 cents.

RP1146. Effect of purification treatments on cotton and rayon. Ruby K. Worner and Ralph T. Mease. Price 5 cents.

RP1147. Formation of hydrated calcium silicates at elevated temperatures and pressures. Einar P. Flint, Howard F. McMurdie, and Lansing S. Wells. Price 10 cents.

RP1148. Calculation of stresses and natural frequencies for a rotating propeller blade vibrating flexurally. Walter Ramberg and Sam Levy. Price 10 cents.

RP1149. Effect of filling and sizing materials on stability of book papers. Merle B. Shaw and Martin J. O'Leary. Price 10 cents.

RP1150. Cesium discharge under conditions of nearly complete ionization. Fred L. Mohler. Price 10 cents.

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrador), Panama, and Venezuela); other countries, 70 cents and $4.50, respectively.

### Building Materials and Structures[2]

[Persons who wish to be notified of new publications in the "Building Materials and Structures" series as soon as they are available should write to the Superintendent of Documents, Government Printing Office, Washington, D. C., asking that their names be placed on the special mailing list maintained by him for this purpose.]

During the past month the following publication in this series was issued:

BMS10. Structural properties of one of the "Keystone Beam Steel Floor" constructions sponsored by the H. H. Robertson Co. Herbert L. Whittemore, Ambrose H. Stang, and Cyrus C. Fishburn. Price 10 cents.

### Simplified Practice Recommendations[2]

R173–38. Stock folding boxes for millinery. Price 5 cents.

### Commercial Standards[2]

CS13–39. Dress patterns. (Supersedes CS13–30.) Price 5 cents.

CS45–38. Douglas fir plywood. (Domestic grades.) (Supersedes CS45–36.) Price 10 cents.

CS73–38. Old growth Douglas fir standard stock doors. Price 10 cents.

### Technical News Bulletin[2]

Technical News Bulletin 262, February 1939. Price 5 cents. Annual subscription, 50 cents.

## RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS[3]

The National Standard of Frequency. Lyman J. Briggs. Tech. Engineering News (Walker Memorial, Cambridge A, Mass.) 19, 193 (January 1939).

Methods of testing thermometers. E. F. Mueller and R. M. Wilhelm. Proc. Am. Soc. Testing Materials (260 South Broad St., Philadelphia, Pa.) 1, part 1 (1938).

Index to the literature on spectrochemical analysis. (Paper covered pamphlet.) William F. Meggers and Bourdon F. Scribner. Am. Soc. Testing Materials (January 1939).

Reports on measurements and investigations undertaken by the colorimetry section, National Bureau of Standards, at the request of the signal section, Association of American Railroads: Report No. 6, Examination of 65 duplicate limit glasses (issued July 26, 1934); Report No. 7, Colorimetric data leading to specification 59–38 for kerosene hand lantern globes; Comparison of specifications 59–38, 69–38, and 69–35; Certification of duplicate lantern glasses (issued Sept. 28, 1938). K. S. Gibson, Geraldine Walker Haupt, and H. J. Keegan. Signal section Proc. Assn. Am. Railroads (30 Vesey St., New York, N. Y.) 36, 136 (1939).

Atomic absorption coefficients and transition probabilities. Fred L. Mohler. Nature (St. Martin's St., London, W. C. 2, England) 142, 1160 (Dec. 31, 1938).

Prevention of sticking of buret stopcocks. E. F. Maczowske. Ind. Eng. Chem., Anal. Ed. (Mills Building, Washington, D. C.) 11, 20 (Jan. 15, 1939).

Current distribution in electrodeposition. I. Linear, cylindrical and spherical conductors. C. Kasper. Mo. Rev. Am. Electroplaters' Soc. (90 Maynard Street, Springfield, Mass.) 26, 11 (January 1939).

Hydrocarbons in the lubricant fraction of petroleum. F. D. Rossini. Proc. Am. Petroleum Inst. (50 West 50th Street, New York, N. Y.) 19 (III), 99 (1938).

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[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrador), Panama, and Venezuela); other countries, 70 cents and $4.50, respectively.

[3] These publications are not obtainable from the Government. Requests should be sent direct to the publishers.

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